DEFENSE INFORMATION SYSTEMS AGENCY
JOINT INTEROPERABILITY TEST COMMAND
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FORT HUACHUCA, ARIZONA 85670-2798

Battlespace Communications Portfolio (JTE)   22 Feb 2008

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the Nortel Optical Multiservice Edge
                    (OME) 6500 with Software Release 4.01

References: (a) DoD Directive 4630.5, "Interoperability and Supportability of Information
                          Technology (IT) and National Security Systems (NSS)," 5 May 2004
                      (b) CJCSI 6212.01D, "Interoperability and Supportability of Information
                          Technology and National Security Systems," 08 March 2006

1. References (a) and (b) establish the Defense Information Systems Agency (DISA), Joint
Interoperability Test Command (JITC), as the responsible organization for interoperability test
certification. Additional references are provided in enclosure 1.

2. The Nortel OME 6500 with Software Release 4.01 is hereinafter referred to as the System
Under Test (SUT). The SUT meets all of the critical interoperability requirements for the
Defense Switched Network (DSN) and is certified for joint use. The SUT met the critical
interoperability requirements for a Strategic Network Element set forth in appendices 5 and 9 of
reference (c) using test procedures derived from reference (d). Although the SUT offers
European Basic Multiplex Rate (E1) access interfaces, these interfaces were not tested by JITC
and are not authorized for use within the DSN by the DSN Program Management Office (PMO).
No other configurations, features, or functions, except those cited within this report, are certified
by the JITC, or authorized by the PMO for use within the DSN. This certification expires upon
changes that affect interoperability, but no later than three years from the date of this
memorandum.

3. This certification is based on interoperability testing and review of vendor's Letters of
Compliance (LoC). Interoperability testing was conducted by JITC at the Global Information
Grid Network Test Facility, Fort Huachuca, Arizona from 22 October through 9 November 2007.
Review of vendor's LoC was completed on 3 December 2007. The Certification Testing
Summary (enclosure 2) documents the test results and describes the test network.

4. The SUT Interoperability Test Summary is shown in table 1 and the Capability and Feature
Requirements used to evaluate the interoperability of the SUT are indicated in table 2.

Table 1. SUT Interoperability Test Summary

DSN Access Interfaces			
DSN Switch Access	**Critical**	**Status**	**Remarks**
T1 CAS (AMI/SF) DTMF, MFR1, DP	No[1]	Certified	Met all CRs and FRs.
T1 CAS (B8ZS/ESF) DTMF, MFR1, DP	No[1]	Certified	Met all CRs and FRs.
T1 PRI (ANSI T1.619a)	No[1]	Certified	Met all CRs and FRs.
T1 SS7 (ANSI T1.619a)	No[1]	Certified	Met all CRs and FRs.
E1 CAS (HDB3) DTMF, MFR1, DP	No[1] (Europe only)	Not Tested	The SUT offers this interface; however, it was not tested. There is no operational impact because it is not a critical requirement for a Strategic Network Element.
E1 ISDN PRI (ITU-T Q.955.3)	No[1] (Europe only)	Not Tested	The SUT offers this interface; however, it was not tested. There is no operational impact because it is not a critical requirement for a Strategic Network Element.
E1 SS7 (ANSI T1.619a)	No[1] (Europe only)	Not Tested	The SUT offers this interface; however, it was not tested. There is no operational impact because it is not a critical requirement for a Strategic Network Element.
DS3	No[1]	Certified	Met all CRs and FRs.
DS3C	No[1]	Certified	Met all CRs and FRs.
Gigabit Ethernet	No[1]	Certified	Met all CRs and FRs.
10 Gigabit Ethernet	No[1]	Certified	Met all CRs and FRs.
DSN Transport Interfaces				
Optical Carrier Level	**Transport Level**	**Critical**	**Status**	**Remarks**
OC-3	VT 1.5	No[2]	Certified	Met all CRs and FRs.
	STS-1	No[2]	Certified	Met all CRs and FRs.
OC-12	VT 1.5	No[2]	Certified	Met all CRs and FRs.
	STS-1	No[2]	Certified	Met all CRs and FRs.
OC-48	VT 1.5	No[2]	Certified	Met all CRs and FRs.
	STS-1	No[2]	Certified	Met all CRs and FRs.
OC-192	VT 1.5	No[2]	Certified	Met all CRs and FRs.
	STS-1	No[2]	Certified	Met all CRs and FRs.
DWDM	10 Gigabit Channel	No[2]	Certified	Met all CRs and FRs.
Features And Capabilities			
Features and Capabilities	**Critical**	**Status**	**Remarks**
Synchronization	Yes	Certified	Met all CRs and FRs.
Network Management	Yes	Certified	Met all CRs and FRs.
Security	Yes	See note 3.	See note 3.

LEGEND:

AMI	- Alternate Mark Inversion	ISDN	- Integrated Services Digital Network
ANSI	- American National Standards Institute	ITU-T	- International Telecommunication Union – Telecommunication Standardization
B8ZS	- Bipolar Eight Zero Substitution	Mbps	- Megabits per second
CAS	- Channel Associated Signaling	MFR1	- Multi-frequency Recommendation 1
CR	- Capability Requirements	MLPP	- Multi-Level Precedence and Preemption
DISA	- Defense Information Systems Agency	OC-3	- Optical Carrier Level 3 (155 Mbps)
DP	- Dial Pulse	OC-12	- Optical Carrier Level 12 (622 Mbps)
DS3	- Digital Signal Level 3 (44.736 Mbps)	OC-48	- Optical Carrier Level 48 (2.448 Gbps)
DS3C	- Digital Signal Level 3 (89.472 Mbps)	OC-192	- Optical Carrier Level 192 (10 Gbps)
DTMF	- Dual Tone Multi-Frequency	PRI	- Primary Rate Interface
DWDM	- Dense Wavelength Division Multiplexing	Q.955.3	- ISDN Signaling Standard for E1 MLPP
DSN	- Defense Switched Network	SF	- Super Frame
E1	- European Basic Multiplex Rate (2.048 Mbps)	SS7	- Signaling System 7
ESF	- Extended Super Frame	SUT	- System Under Test
FR	- Feature Requirements	STS	- Synchronous Transport Signal
Gbps	- Gigabits per second	T1	- Digital Transmission Link Level 1 (1.544 Mbps)
GSCR	- Generic Switching Center Requirements	T1.619a	- SS7 and ISDN MLPP Signaling Standard for T1
HDB3	- High Density Bipolar 3	VT	- Virtual Tributary

NOTES:
1   The GSCR does not stipulate a minimum Access interface requirement for a Strategic Network Element.
2   The GSCR does not stipulate a minimum Transport interface requirement for a Strategic Network Element.
3   Information assurance testing is accomplished via DISA-led Information Assurance test teams and published in a separate report.

Table 2. SUT Capability and Feature Interoperability Requirements

DSN Access Interfaces			
Interface	**Critical**	**Requirements Required or Conditional**	**References**
T1 CAS	No[1]	• DS1 Interface Characteristics (C)	• GSCR para. A9.5.1.2.4
		• DS1 Supervisory Channel Associated Signaling (C)	• GSCR para. A9.5.1.2.4
T1 SS7 (ANSI T1.619a)	No[1]	• DS1 Clear Channel Capability (C)	• GSCR para. A9.5.1.2.4
T1 ISDN PRI (ANSI T1.607/ANSI T1.619a)	No[1]	• DS1 Alarm and Restoral Requirements (C)	• GSCR para. A9.5.1.2.4
		• E1 Interface Characteristics (C)	• GSCR para. A9.5.1.2.5
		• E1 Supervisory Channel Associated Signaling (C)	• GSCR para. A9.5.1.2.5
E1 ISDN PRI (ITU-T Q.955.3)	No[1] (Europe only)	• E1 Clear Channel Capability (C)	• GSCR para. A9.5.1.2.5
E1 CAS	No[1] (Europe only)	• E1 Alarm and Restoral Requirements (C)	• GSCR para. A9.5.1.2.5
		• MOS (R)	• GSCR para. A9.5.1.1
E1 SS7 (ANSI T1.619a)	No[1] (Europe only)	• BERT (R)	• GSCR para. A9.5.1.1
		• Secure Transmission (Voice and Data) (R)	• GSCR para. A9.5.1.1
		• Modem (R)	• GSCR para. A9.5.1.1
		• Facsimile (R)	• GSCR para. A9.5.1.1
DS3, DS3C	No[1]	• Call Control Signals (R)	• GSCR para. A9.5.1.1
		• Delay (R)	• GSCR para. A9.5.1.1
10/100 Mbps Ethernet	No[1]	• Call Congestion Control (R)	• GSCR para. A9.5.1.1
		• Call Congestion (R)	• GSCR para. A9.5.1.1.3
Gigabit Ethernet	No[1]	• Voice Compression (C)	• GSCR para. A9.5.1.1.4
		• DS3 Interface Requirements (R)	• GSCR para. A9.5.1.2.6
10 Gigabit Ethernet	No[1]	• IP Interface (C)	• GSCR para. A9.5.1.2.9
DSN Transport Interfaces			
Interface	**Critical**	**Requirements Required or Conditional**	**References**
OC-3	No[2]	• MLPP (R)	• GSCR para. A5.5.1
		• GR-303-CORE (R)	• GSCR para. A5.5.2
		• GR-253-CORE (R)	• GSCR para. A5.5.2
		• GR-782-CORE (R)	• GSCR para. A5.5.2
		• ANSI T1.105-2001 (R)	• GSCR para. A5.5.2
		• DS1 Rate Transport via VT1.5 (R)	• GSCR para. A5.5.2
		• DS1 Rate Provisioning (R)	• GSCR para. A5.5.2
OC-12	No[2]	• DS0 Call Processing (R)	• GSCR para. A5.5.2
		• DS0 to OC-3 Route Assignment (R)	• GSCR para. A5.5.3
		• Facility Alarms (R)	• GSCR para. A5.5.4
		• DS1 AIS/Yellow (R)	• GSCR para. A5.5.4
OC-48	No[2]	• DS0 AIS/DS0 RAI (R)	• GSCR para. A5.5.4
		• Synchronization in accordance with GR-518-CORE (R)	• GSCR para. A5.5.5
		• Synchronization in accordance with GR-253-CORE (R)	• GSCR para. A5.5.5
		• Synchronization in accordance with GR-436-CORE (R)	• GSCR para. A5.5.5
		• Reliability (R)	• GSCR para. A5.5.6
OC-192	No[2]	• Security (R)	• GSCR para. A5.6
		• MOS (R)	• GSCR para. A9.5.1.1
		• BERT (R)	• GSCR para. A9.5.1.1
		• Secure Transmission (Voice and Data) (R)	• GSCR para. A9.5.1.1
		• Modem (R)	• GSCR para. A9.5.1.1
		• Facsimile (R)	• GSCR para. A9.5.1.1
DWDM	No[2]	• Call Control Signals (R)	• GSCR para. A9.5.1.1
		• Delay (R)	• GSCR para. A9.5.1.1
		• Call Congestion Control (R)	• GSCR para. A9.5.1.1.3
		• Voice Compression (C)	• GSCR para. A9.5.1.1.4

Table 2. SUT Capability and Feature Interoperability Requirements (continued)

SUT Features And Capabilities			
Feature/Capability	**Critical**	**Requirements Required or Conditional**	**References**
Synchronization	Yes	• Timing (R)	• GSCR para. A9.5.1.2.7
Network Management	Yes	• Management Option (R) - Local Management (Front Panel and/or External Console) (C) - ADIMSS (C) • Fault Management (C) • Loop Back Capability (C) • Operational Configuration Restoral (R)	• GSCR para. A9.5.2.1 • GSCR para. A9.5.2.2 • GSCR para. A9.5.2.3 • GSCR para. A9.5.3
Security	Yes	• DIACAP (replacement for DITSCAP) (R)	• GSCR para. A9.6

LEGEND:

A	- Appendix	IP	- Internet Protocol
ADIMSS	- Advanced DSN Integrated Management Support System	ISDN	- Integrated Services Digital Network
ANSI	- American National Standards Institute	ITU-T	- International Telecommunication Union - Telecommunication Standardization Sector
AIS	- Alarm Indication Signal		
BERT	- Bit Error Rate Test	LSSGR	- Local Access and Transport Area (LATA) Switching Systems Generic Requirements
C	- Conditional		
CAS	- Channel Associated Signaling	Mbps	- Megabits per second
DIACAP	- DoD Information Assurance Certification and Accreditation Process	MLPP	- Multi-Level Precedence and Preemption
DITSCAP	- DoD Information Technology Security Certification and Accreditation Process	MOS	- Mean Opinion Score
		OC-3	- Optical Carrier Level 3 (155 Mbps)
DoD	- Department of Defense	OC-12	- Optical Carrier Level 12 (622 Mbps)
DS0	- Digital Signal Level 0	OC-48	- Optical Carrier Level 48 (2.448 Gbps)
DS1	- Digital Signal Level 1	OC-192	- Optical Carrier Level 192 (10 Gbps)
DS3	- Digital Signal Level 3	Para	- paragraph
DSN	- Defense Switched Network	PRI	- Primary Rate Interface
DSS1	- Digital Subscriber Signaling 1	Q.955.3	- ISDN Signaling standard for E1 MLPP
DWDM	- Dense Wavelength Division Multiplexing	R	- Required
E1	- European Basic Multiplex Rate (2.048 Mbps)	RAI	- Remote Alarm Indication
Gbps	- Gigabits per second	SONET	- Synchronous Optical Network
GR	- Generic Requirement	SS7	- Signaling System 7
GR-253-CORE	- SONET Transport Systems: Common Generic Criteria	SUT	- System Under Test
GR-303-CORE	- Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface	T1	- Digital Transmission Link Level 1 (1.544 Mbps)
		T1.105-2001	- SONET – Basic Description include Multiplexer structure, rates, formats
GR-436-CORE	- Digital Network Synchronization Plan	T1.607	- ISDN – Layer 3 Signaling Specification for Circuit Switched Bearer Service for DSS1
GR-518-CORE	- LSSGR: Synchronization, Section 18		
GR-782-CORE	- SONET Digital Switch Trunk Interface Criteria	T1.619a	- SS7 and ISDN MLPP Signaling Standard for T1
GSCR	- Generic Switching Center Requirement	VT1.5	- Virtual Tributary 1.5

NOTES:
1 The GSCR does not stipulate a minimum Access interface requirement for a Strategic Network Element.
2 The GSCR does not stipulate a minimum Transport interface requirement for a Strategic Network Element.

5. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at https://stp.fhu.disa.mil. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at http://jit.fhu.disa.mil (NIPRNet), or http://199.208.204.125 (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at http://jitc.fhu.disa.mil/tssi.

JITC Memo, JTE, Special Interoperability Test Certification of the Nortel Optical Multiservice Edge (OME) 6500 with Software Release 4.01

6. The JITC point of contact is Capt. Oskar Widecki, DSN 879-5269, commercial (520) 538-5269, FAX DSN 879-4347, or e-mail oskar.widecki@disa.mil. The tracking number for the SUT is 0712401.

FOR THE COMMANDER:

2 Enclosures a/s   RICHARD A. MEADOR
                                           Chief
                                           Battlespace Communications Portfolio

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ADDITIONAL REFERENCES

(c)   Defense Information Systems Agency, "Department of Defense Voice Networks Generic Switching Center Requirements (GSCR), Errata Change 2," 14 December 2006, Revised 27 March 2007

(d)   Joint Interoperability Test Command, "Defense Switched Network Generic Switch Test Plan (GSTP), Change 2," 2 October 2006

Enclosure 1

CERTIFICATION TESTING SUMMARY

1. SYSTEM TITLE. Nortel Optical Multiservice Edge (OME) 6500 with Software Release 4.0.1, hereinafter referred to as the System Under Test (SUT).

2. PROPONENTS. Air Mobility Command (AMC).

3. PROGRAM MANAGER. Ms. Mary Stovey, AMC, A6NI, 203 W Loset St., Scott Air Force Base, Illinois, 62225, e-mail: mary.stovey@scott.af.mil.

4. TESTER. Joint Interoperability Test Command (JITC), Fort Huachuca, Arizona.

5. SYSTEM UNDER TEST DESCRIPTION. The SUT combines and extends Synchronous Optical Network (SONET)/Synchronous Digital Hierarchy (SDH) and metropolitan Dense Wavelength Division Multiplexing (DWDM) platforms for converged time division multiplexing (TDM), data, wavelength, and transparent services transport over a single consolidated multi-service optical platform. The optical networking platforms are capable of efficiently aggregating, switching, and managing a mix of global services ranging from the lower speed Digital Signal Level 1 (DS1), European Basic Multiplex Rate (E1), and Digital Signal Level 3 (DS3) electrical interfaces and the higher speed Optical Carrier Level 3 (OC-3), Optical Carrier Level 12 (OC-12), Optical Carrier Level 48 (OC-48), and Optical Carrier Level 192 (OC-192) interfaces. The SUT is a global platform that can be deployed in both SONET and SDH environments. The SONET and SDH protocols are supported on the same circuit pack and can be provisioned by the user. The SUT also supports a 1 Gigabits per second (Gbps) Resilient Packet Ring (RPR), which is a ring based technology that enables bandwidth sharing across multiple Ethernet ports. The SUT provides common transport for TDM and data interfaces to support voice transport. Deployed in a ring transport topology, the SUT has a main shelf that has an Internet Protocol (IP) connection supporting Secure Shell (SSH). This IP connection will allow a base to have each user first authenticate with a Remote Authentication Dial In User Service (RADIUS) server. After successful authentication, the user can then access the SUT network and perform assigned duties. Remote locations are visible from the secure SSH IP connection of the main shelf. At remote shelves, all access ports are turned off denying anyone access to the network. Each OME 6500 remote shelf will be contained in a protected enclave preventing unauthorized access to the site. This, in turn, prevents unauthorized personnel from attempting to access remote shelves. Although the SUT offers European Basic Multiplex Rate (E1) access interfaces, these interfaces were not tested by JITC and are not authorized for use within the Defense Switched Network (DSN) by the DSN Program Management Office (PMO). The Preside Site Manager version 4.0 with Consolidated Craft Base 1.5 is the client Graphical User Interface used to monitor and control the SUT. All management and real-time visibility functions are available via this client. The client includes a visual representation of all SUT system hardware and each monitored circuit.

6. OPERATIONAL ARCHITECTURE. The Generic Switching Center Requirements (GSCR) DSN operational architecture is depicted in figure 2-1.

LEGEND:

4W	- 4-Wire
BRI	- Basic Rate Interface
CB	- Channel Bank
COI	- Community of Interest
CSN	- Canadian Switch Network
DRSN	- Defense Red Switch Network
DSN	- Defense Switched Network
DVX	- Deployable Voice Exchange
EMSS	- Enhanced Mobile Satellite System
EO	- End Office
IAS	- Integrated Access Switch
ISDN	- Integrated Services Digital Network
IST	- Interswitch Trunk
MFS	- Multifunction Switch
NATO	- North Atlantic Treaty Organization

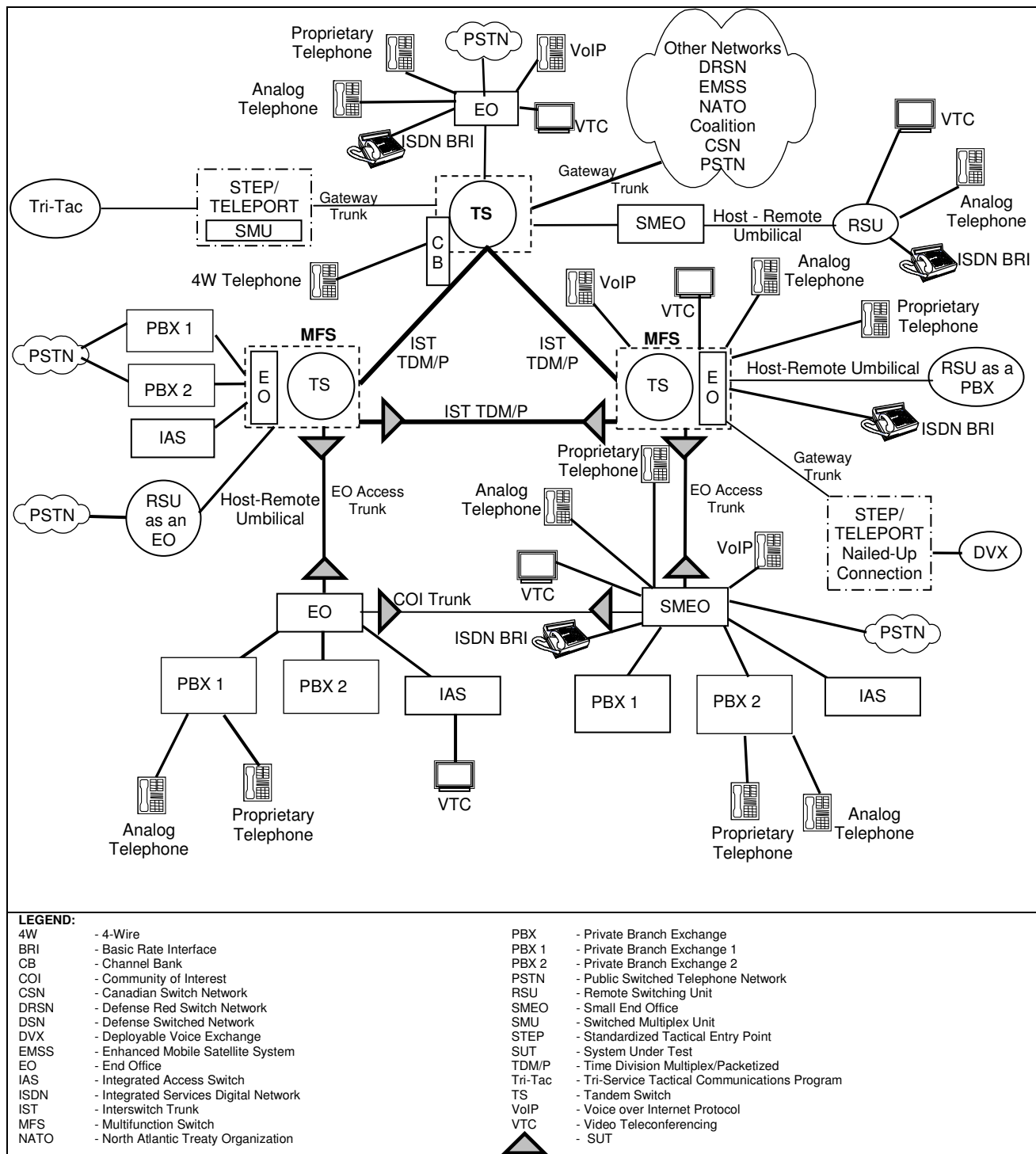|	
PBX	- Private Branch Exchange
PBX 1	- Private Branch Exchange 1
PBX 2	- Private Branch Exchange 2
PSTN	- Public Switched Telephone Network
RSU	- Remote Switching Unit
SMEO	- Small End Office
SMU	- Switched Multiplex Unit
STEP	- Standardized Tactical Entry Point
SUT	- System Under Test
TDM/P	- Time Division Multiplex/Packetized
Tri-Tac	- Tri-Service Tactical Communications Program
TS	- Tandem Switch
VoIP	- Voice over Internet Protocol
VTC	- Video Teleconferencing
	- SUT

Figure 2-1. DSN Architecture

7. REQUIRED SYSTEM INTERFACES. The SUT Interoperability Test Summary is shown in table 2-1 and the Capability and Feature Requirements used to evaluate the interoperability of the SUT are indicated in table 2-2.

Table 2-1. SUT Interoperability Test Summary

DSN Access Interfaces			
DSN Switch Access	**Critical**	**Status**	**Remarks**
T1 CAS (AMI/SF) DTMF, MFR1, DP	No[1]	Certified	Met all CRs and FRs.
T1 CAS (B8ZS/ESF) DTMF, MFR1, DP	No[1]	Certified	Met all CRs and FRs.
T1 PRI (ANSI T1.619a)	No[1]	Certified	Met all CRs and FRs.
T1 SS7 (ANSI T1.619a)	No[1]	Certified	Met all CRs and FRs.
E1 CAS (HDB3) DTMF, MFR1, DP	No[1] (Europe only)	Not Tested	The SUT offers this interface; however, it was not tested. There is no operational impact because it is not a critical requirement for a Strategic Network Element.
E1 ISDN PRI (ITU-T Q.955.3)	No[1] (Europe only)	Not Tested	The SUT offers this interface; however, it was not tested. There is no operational impact because it is not a critical requirement for a Strategic Network Element.
E1 SS7 (ANSI T1.619a)	No[1] (Europe only)	Not Tested	The SUT offers this interface; however, it was not tested. There is no operational impact because it is not a critical requirement for a Strategic Network Element.
DS3	No[1]	Certified	Met all CRs and FRs.
DS3C	No[1]	Certified	Met all CRs and FRs.
Gigabit Ethernet	No[1]	Certified	Met all CRs and FRs.
10 Gigabit Ethernet	No[1]	Certified	Met all CRs and FRs.
DSN Transport Interfaces				
Optical Carrier Level	**Transport Level**	**Critical**	**Status**	**Remarks**
OC-3	VT 1.5	No[2]	Certified	Met all CRs and FRs.
OC-3	STS-1	No[2]	Certified	Met all CRs and FRs.
OC-12	VT 1.5	No[2]	Certified	Met all CRs and FRs.
OC-12	STS-1	No[2]	Certified	Met all CRs and FRs.
OC-48	VT 1.5	No[2]	Certified	Met all CRs and FRs.
OC-48	STS-1	No[2]	Certified	Met all CRs and FRs.
OC-192	VT 1.5	No[2]	Certified	Met all CRs and FRs.
OC-192	STS-1	No[2]	Certified	Met all CRs and FRs.
DWDM	10 Gigabit Channel	No[2]	Certified	Met all CRs and FRs.
Features And Capabilities				
Features and Capabilities	**Critical**	**Status**	**Remarks**	
Synchronization	Yes	Certified	Met all CRs and FRs.	
Network Management	Yes	Certified	Met all CRs and FRs.	
Security	Yes	See note 3.	See note 3.	

Table 2-1. SUT Interoperability Test Summary (Continued)

LEGEND:

AMI	- Alternate Mark Inversion	ITU-T	- International Telecommunication Union – Telecommunication Standardization
ANSI	- American National Standards Institute		
B8ZS	- Bipolar Eight Zero Substitution	Mbps	- Megabits per second
CAS	- Channel Associated Signaling	MFR1	- Multi-frequency Recommendation 1
CR	- Capability Requirements	MLPP	- Multi-Level Precedence and Preemption
DISA	- Defense Information Systems Agency	NE	- Network Element
DP	- Dial Pulse	OC-3	- Optical Carrier Level 3 (155 Mbps)
DS3	- Digital Signal Level 3 (44.736 Mbps)	OC-12	- Optical Carrier Level 12 (622 Mbps)
DS3C	- Digital Signal Level 3 (89.472 Mbps)	OC-48	- Optical Carrier Level 48 (2.448 Gbps)
DTMF	- Dual Tone Multi-Frequency	OC-192	- Optical Carrier Level 192 (10 Gbps)
DWDM	- Dense Wavelength Division Multiplexing	PRI	- Primary Rate Interface
DSN	- Defense Switched Network	Q.955.3	- ISDN Signaling Standard for E1 MLPP
E1	- European Basic Multiplex Rate (2.048 Mbps)	SF	- Super Frame
ESF	- Extended Super Frame	SS7	- Signaling System 7
FR	- Feature Requirements	SUT	- System Under Test
Gbps	- Gigabits per second	STS	- Synchronous Transport Signal
GSCR	- Generic Switching Center Requirements	T1	- Digital Transmission Link Level 1 (1.544 Mbps)
HDB3	- High Density Bipolar 3	T1.619a	- SS7 and ISDN MLPP Signaling Standard for T1
ISDN	- Integrated Services Digital Network	VT	- Virtual Tributary

NOTES:
1   The GSCR does not stipulate a minimum Access interface requirement for a Strategic Network Element.
2   The GSCR does not stipulate a minimum Transport interface requirement for a Strategic Network Element.
3   Information assurance testing is accomplished via DISA-led Information Assurance test teams and published in a separate report.

Table 2-2. SUT Capability and Feature Interoperability Requirements

DSN Access Interfaces			
Interface	**Critical**	**Requirements Required or Conditional**	**References**
T1 CAS	No[1]	• DS1 Interface Characteristics (C)	• GSCR para. A9.5.1.2.4
T1 SS7 (ANSI T1.619a)	No[1]	• DS1 Supervisory Channel Associated Signaling (C)	• GSCR para. A9.5.1.2.4
T1 ISDN PRI (ANSI T1.607/ANSI T1.619a)	No[1]	• DS1 Clear Channel Capability (C) • DS1 Alarm and Restoral Requirements (C)	• GSCR para. A9.5.1.2.4 • GSCR para. A9.5.1.2.4
E1 ISDN PRI (ITU-T Q.955.3)	No[1] (Europe only)	• E1 Interface Characteristics (C) • E1 Supervisory Channel Associated Signaling (C) • E1 Clear Channel Capability (C)	• GSCR para. A9.5.1.2.5 • GSCR para. A9.5.1.2.5 • GSCR para. A9.5.1.2.5
E1 CAS	No[1] (Europe only)	• E1 Alarm and Restoral Requirements (C) • MOS (R)	• GSCR para. A9.5.1.2.5 • GSCR para. A9.5.1.1
E1 SS7 (ANSI T1.619a)	No[1] (Europe only)	• BERT (R) • Secure Transmission (Voice and Data) (R)	• GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1
DS3, DS3C	No[1]	• Modem (R)	• GSCR para. A9.5.1.1
10/100 Mbps Ethernet	No[1]	• Facsimile (R) • Call Control Signals (R)	• GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1
Gigabit Ethernet	No[1]	• Delay • Call Congestion Control (R)	• GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1.3
10 Gigabit Ethernet	No[1]	• Voice Compression (C) • DS3 Interface Requirements (R) • IP Interface (C)	• GSCR para. A9.5.1.1.4 • GSCR para. A9.5.1.2.6 • GSCR para. A9.5.1.2.9

Table 2-2. SUT Capability and Feature Interoperability Requirements (continued)

DSN Transport Interfaces			
Interface	**Critical**	**Requirements Required or Conditional**	**References**
OC-3	No[2]	• MLPP (R)	• GSCR para. A5.5.1
		• GR-303-CORE (R)	• GSCR para. A5.5.2
		• GR-253-CORE (R)	• GSCR para. A5.5.2
		• GR-782-CORE (R)	• GSCR para. A5.5.2
		• ANSI T1.105-2001 (R)	• GSCR para. A5.5.2
		• DS1 Rate Transport via VT1.5 (R)	• GSCR para. A5.5.2
OC-12	No[2]	• DS1 Rate Provisioning (R)	• GSCR para. A5.5.2
		• DS0 Call Processing (R)	• GSCR para. A5.5.2
		• DS0 to OC-3 Route Assignment (R)	• GSCR para. A5.5.3
		• Facility Alarms (R)	• GSCR para. A5.5.4
		• DS1 AIS/Yellow (R)	• GSCR para. A5.5.4
OC-48	No[2]	• DS0 AIS/DS0 RAI (R)	• GSCR para. A5.5.4
		• Synchronization in accordance with GR-518-CORE (R)	• GSCR para. A5.5.5
		• Synchronization in accordance with GR-253-CORE (R)	• GSCR para. A5.5.5
		• Synchronization in accordance with GR-436-CORE (R)	• GSCR para. A5.5.5
		• Reliability (R)	• GSCR para. A5.5.6
		• Security (R)	• GSCR para. A5.6
OC-192	No[2]	• MOS (R)	• GSCR para. A9.5.1.1
		• BERT (R)	• GSCR para. A9.5.1.1
		• Secure Transmission (Voice and Data) (R)	• GSCR para. A9.5.1.1
		• Modem (R)	• GSCR para. A9.5.1.1
		• Facsimile (R)	• GSCR para. A9.5.1.1
		• Call Control Signals (R)	• GSCR para. A9.5.1.1
		• Delay (R)	• GSCR para. A9.5.1.1
DWDM	No[2]	• Call Congestion Controls (R)	• GSCR para. A9.5.1.1.3
		• Voice Compression (C)	• GSCR para. A9.5.1.1.4

SUT Features And Capabilities			
Feature/ Capability	**Critical**	**Requirements Required or Conditional**	**References**
Synchronization	Yes	• Timing (R)	• GSCR para. A9.5.1.2.7

Network Management	Yes	• Management Option (R)
		   - Local Management (Front Panel and/or External Console) (C)
		   - ADIMSS (C)
		 • Fault Management (C)
		 • Loop Back Capability (C)
		 • Operational Configuration Restoral (R)
			• GSCR para. A9.5.2.1
			
			 • GSCR para. A9.5.2.2
			 • GSCR para. A9.5.2.3
			 • GSCR para. A9.5.3

Security	Yes	• DIACAP (replacement for DITSCAP) (R)	• GSCR para. A9.6

Table 2-2. SUT Capability and Feature Interoperability Requirements (continued)

```
LEGEND:
A              - Appendix                                              IP            - Internet Protocol
ADIMSS         - Advanced DSN Integrated Management Support System     ISDN          - Integrated Services Digital Network
ANSI           - American National Standards Institute                ITU-T         - International Telecommunication Union - Telecommunication
AIS            - Alarm Indication Signal                                               Standardization Sector
BERT           - Bit Error Rate Test                                   LSSGR         - Local Access and Transport Area (LATA) Switching Systems Generic
C              - Conditional                                                            Requirements
CAS            - Channel Associated Signaling                          Mbps          - Megabits per second
DIACAP         - DoD Information Assurance Certification and Accreditation   MLPP     - Multi-Level Precedence and Preemption
                 Process                                               MOS           - Mean Opinion Score
DITSCAP        - DoD Information Technology Security Certification and  OC-3          - Optical Carrier Level 3 (155 Mbps)
                 Accreditation Process                                 OC-12         - Optical Carrier Level 12 (622 Mbps)
DoD            - Department of Defense                                 OC-48         - Optical Carrier Level 48 (2.448 Gbps)
DS0            - Digital Signal Level 0                                OC-192        - Optical Carrier Level 192 (10 Gbps)
DS1            - Digital Signal Level 1                                Para          - paragraph
DS3            - Digital Signal Level 3                                PRI           - Primary Rate Interface
DSN            - Defense Switched Network                              Q.955.3       - ISDN Signaling standard for E1 MLPP
DSS1           - Digital Subscriber Signaling 1                        R             - Required
DWDM           - Dense Wavelength Division Multiplexing                RAI           - Remote Alarm Indication
E1             - European Basic Multiplex Rate (2.048 Mbps)            SONET         - Synchronous Optical Network
Gbps           - Gigabits per second                                  SS7           - Signaling System 7
GR             - Generic Requirement                                  SUT           - System Under Test
GR-253-CORE    - SONET Transport Systems: Common Generic Criteria      T1            - Digital Transmission Link Level 1 (1.544 Mbps)
GR-303-CORE    - Integrated Digital Loop Carrier System Generic Requirements,   T1.105-2001  - SONET – Basic Description include Multiplexer structure, rates,
                 Objectives, and Interface                                             formats
GR-436-CORE    - Digital Network Synchronization Plan                  T1.607        - ISDN – Layer 3 Signaling Specification for Circuit Switched Bearer
GR-518-CORE    - LSSGR: Synchronization, Section 18                                     Service for DSS1
GR-782-CORE    - SONET Digital Switch Trunk Interface Criteria         T1.619a       - SS7 and ISDN MLPP Signaling Standard for T1
GSCR           - Generic Switching Center Requirement                  VT1.5         - Virtual Tributary 1.5

NOTES:
1   The GSCR does not stipulate a minimum Access interface requirement for a Strategic Network Element.
2   The GSCR does not stipulate a minimum Transport interface requirement for a Strategic Network Element.
```

8. TEST NETWORK DESCRIPTION. The SUT was tested at JITC's Global Information Grid Network Test Facility in a manner and configuration similar to that of the DSN operational environment. This test was conducted using the test configuration shown in figures 2-2 and 2-3.   Figure 2-2 depicts the SUT TDM test configuration. Figure 2-3 depicts the SUT IP test configuration with DWDM and OC-192 transport interfaces.
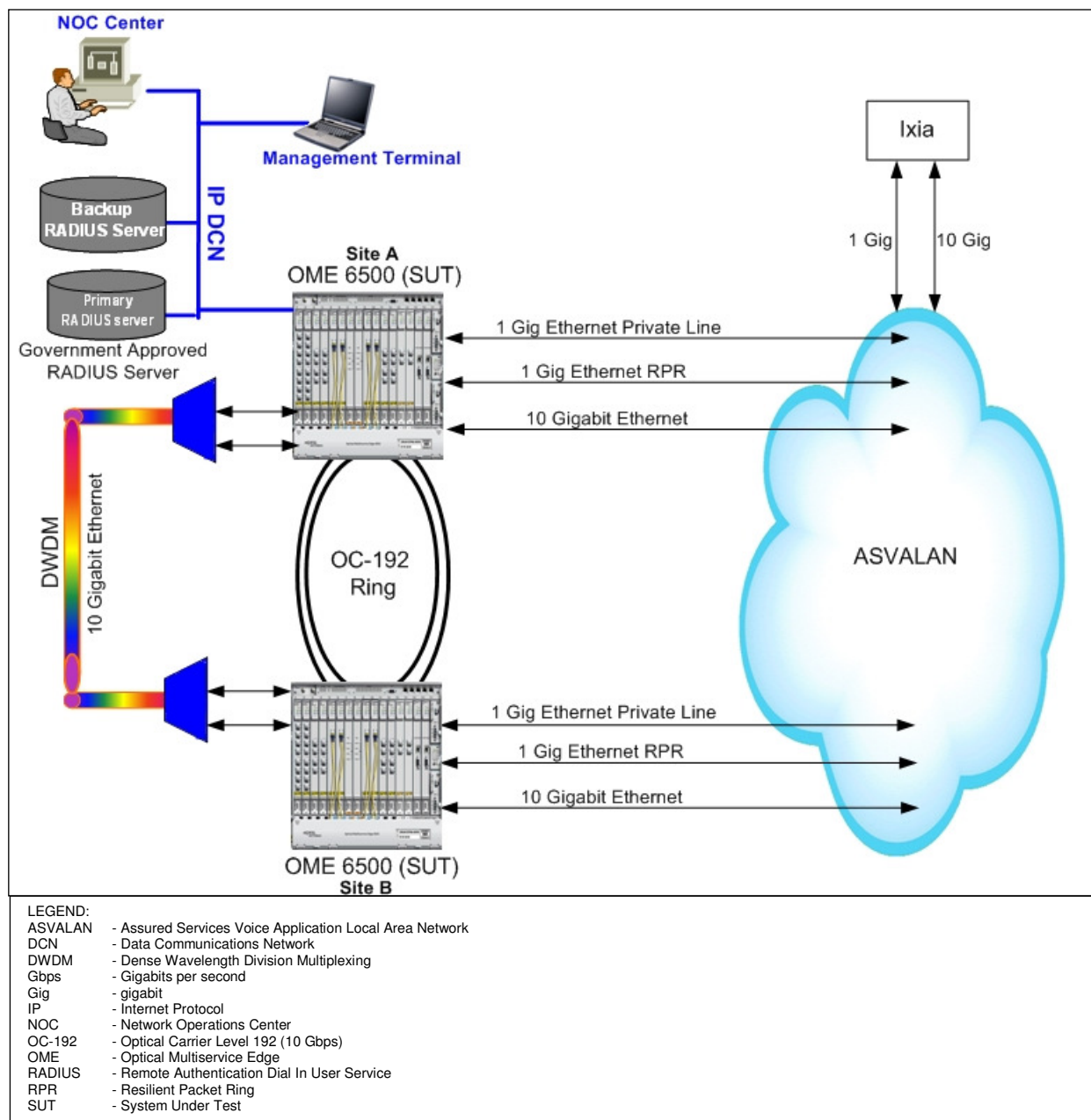
Figure 2-2. SUT TDM Test Configuration

LEGEND:

5ESS	- Class 5 Electronic Switching System	EIA	- Electronic Industries Alliance	MX	- Multiplexer	RADIUS - Remote Authentication Dial In User Service
BRI	- Basic Rate Interface	EIA-530	- Standard for 25-position interface for data terminal equipment	NOC	- Network Operations Center	SS7 - Signaling System 7
CAS	- Channel Associated Signaling		and data circuit-terminating equipment employing serial	OC-3	- Optical Carrier Level 3 (155 Mbps)	STE - Secure Terminal Equipment
CS	- Communication Server		binary data interchange	OC-12	- Optical Carrier Level 12 (622 Mbps)	STU - Secure Telephone Unit
DCN	- Data Communications Network	EWSD	- Elektronisches Wählsystem Digital	OC-48	- Optical Carrier Level 48 (2.448 Gbps)	SUT - System Under Test
DS3	- Digital Signal Level 3	Gbps	- Gigabits per second	OC-192	- Optical Carrier Level 192 (10 Gbps)	SWT - Secure Wireline Terminal
DS3C	- Digital Signal Level 3 Concantenated	IP	- Internet Protocol	OME	- Optical Multiservice Edge	T1 - Digital Transmission Link Level 1 (1.544
DSM	- Digital Signal Level 1 (DS1) Service Module	Mbps	- Megabits per second	PRI	- Primary Rate Interface	Mbps)

Figure 2-3. SUT IP Test Configuration

9. SYSTEM CONFIGURATIONS. Table 2-3 lists the system configurations used in the test. The SUT was tested in an operationally realistic environment to determine interoperability with a complement of DSN switches noted in table 2-3. The DSN switches listed in table 2-3 only depict the tested configuration. Table 2-3 is not intended to identify the only switches that are certified with the SUT. The SUT is certified with switching systems listed on the DSN Approved Products List (APL) that offer the same certified interfaces.

Table 2-3. Tested System Configurations

System Name	Software Release			
Nortel CS2100 (CCA)	Succession Enterprise (SE)09.1			
Siemens EWSD	19d with Patch Set 46			
Alcatel-Lucent 5ESS	5E16.2, Broadcast Warning Message (BWM) 07-0003			
Avaya S8710	Communication Manager (CM) 4.0 (R014x.00.2.731.7) patch 14419			
Adtran MX2800	Code Version 3.20A			
	Hardware	**Card Name**	**Part Number**	**Version**
	OME 6500 (Site A)	DS3/EC1 24 Ports	NTK543NA	02
		GE EPL 4 Ports SFP	NTK535LA	04
		OC-3/12/STM-1/4 VT1.5/LO 8 Ports SFP	NTK513DA	06
				04
		OC-192/STM-64 VT1.5/LO 1 Port G.709 DWDM	NTK52JAE5	01
		X-Conn 80G 20G VT1.5/VC-12 Sync-ST3	NTK557PA	04
		10GE LAN/WAN 10G EPL 1 Port XFP	NTK533AAE5	02
		RPR 10 GE STS-1/HO 4 Ports SFP	NTK5348AE5	06A
		OC-48/STM-16 VT1.5/LO 2 Ports SFP	NTK517BA	03
		NGM WT 1x10GE LAN 1x11.1G DWDM	NTK530AB	15
			NTK530ABE5	22
		Processor SP	NTK555AA	07
		40 Amp Power Input Card Breakered 2 Wire	NTK505YA	02
SUT	OME 6500 (Site B)	DS3/EC1 24 Ports	NTK543NA	02
		GE EPL4 Ports SFP	NTK535LA	03A
		OC-3/12/STM-1/4 VT1.5/LO 8 Ports SFP	NTK513DA	04
				06
		OC-192/STM-64 VT1.5/LO 1 Port G.709 DWDM	NTK527JAE5	01
		X-Conn 80G 20G VT1.5/VC-12 Sync-ST3	NTK557PA	04
		10GE LAN/WAN 10G EPL 1 Port XFP	NTK534BAE5	02
		RPR 10 GE STS-1/HO 4 Ports SFP	NTK534BA	06
		OC-48/STM-16 VT1.5/LO 2 Ports SFP	NTK517BA	03
		NGM WT 1x10GE LAN 1x11.1G DWDM	NTK530AB	15
			NTK530ABE5	22
		Processor SP	NTK555AA	07
		40 Amp Power Input Card Breakered 2 Wire	NTK505CE	02
	Service Module DSM-1	Fan	NTN355AA	04
		OAM Extender	NTN31112	02
		DS-1	NTN312AA	04
		84xDS1TM	NTN313AC	01
	Service Module DSM-2	Fan	NTN355AA	04
		OAM Extender	NTN31112	02
		DS-1	NTN312AA	04
		84xDS1TM	NTN313AC	04
	Management Terminal	Windows XP with Service Pack 2, RAM=512 MB, Hard Drive Size=80 GB, Processor Type=Intel Celeron, Processor Speed=2.80 GHz Preside Site Manager Release 4.0		

Table 2-3. Tested System Configurations (continued)

LEGEND:			
5ESS	- Class 5 Electronic Switching System	NTN	- Nortel Networks
CCA	- Compact Call Agent	OAM	- Operations, Administration, and Maintenance
CS	- Communication Server	OC	- Optical Carrier
DS-1	- Digital Signal Level 1	OC-3	- Optical Carrier Level 3 (155 Mbps)
DS1	- Digital Signal Level 1	OC-12	- Optical Carrier Level 12 (622 Mbps)
DS3	- Digital Signal Level 3	OC-48	- Optical Carrier Level 48 (2.488 Gbps)
DSM	- DS1 Service Module	OC-192	- Optical Carrier Level 192 (10 Gbps)
DWDM	- Dense Wavelength Division Multiplexing	OME	- Optical Multi-service Edge
EC	- Electrical Carrier	R	- Release
EC1	- Electrical Carrier Level 1	RAM	- Random Access Memory
EPL	- Ethernet Private Line	RPR	- Resilient Packet Ring
EWSD	- Elektronisches Wählsystem Digital	SFP	- Small Form Factor Pluggable
G.709	- ITU-T Recommendation for Interfaces for the Optical Transport Network (OTN)	SP	- Shelf Processor
		STM	- Synchronous Transport Module
G	- Gigabit	STM-1/4	- Synchronous Transport Mode ¼ (38.88 Mbps)
GB	- Gigabyte	STM-16	- Synchronous Transport Mode 16 (2488.32 Mbps)
Gbps	- Gigabits per second	STM-64	- Synchronous Transport Mode 64 (9953.28 Mbps)
GE	- Gigabit Ethernet	STS	- Synchronous Transport Signal
GHz	- Gigahertz	Sync-ST3	- Synchronous Traceable Stratum 3 (Accuracy 4.6 x 10^{-6})
HO	- High Order	TM	- Terminal Multiplexer
ITU-T	- International Telecommunication Union - Telecommunication Standardization Sector	VC-12	- Virtual Containers 12 (2.048 Mbps)
		VT1.5	- Virtual Tributary 1.5
LAN	- Local Area Network	WAN	- Wide Area Network
LO	- Low Order	WT	- Wavelength Translators
MB	- Megabyte	X-Conn	- Cross Connect
Mbps	- Megabits per second	XFP	- 10 Gigabit Small Form Factor Pluggable Module
NGM	- Next Generation Modem	XP	- Experience
NTK	- Nortel Networks		

10. TEST LIMITATIONS. None.

11. TEST RESULTS

a. Discussion

(1) Synchronization. Synchronization is a network level application that ensures all nodes across a network can trace back to the same clock source. The SUT provides system synchronization using 1+1 redundant synchronization hardware on the cross-connect circuit pack for both timing generation and timing distribution. The SUT supports an external synchronization mode parameter, which allows the signal format of the External Synchronization Input/External Synchronization Output (ESI/ESO) ports and Synchronization Status Messages (SSM) support to be provisioned independently from the Network Element (NE) mode. The external synchronization mode allows for global gateway applications, where a network element in one NE mode can be timed with signals from a different external synchronization mode (for example, an SDH network element timed with DS1 signals). The external synchronization mode sets the signal format of the ESI and ESO ports as follows:

• SONET: DS1
• SDH: E1 or 2 Megahertz (MHz)
• SDH-J: 64 kilohertz (kHz) CC (ESI) and 6 MHz (ESO)

The SUT has the ability to extract and use the synchronization reference from any of the defined synchronization inputs. The SUT generates shelf timing signals based on external, line, or internal (free run or holdover) references. The SUT supports a timing generation hierarchy of up to four timing references. The SUT is capable of generating a redundant Stratum 3 (+/-4.6 parts per million) quality clock internally (internal timing

mode). This clock is the default synchronization reference. The SUT met the GSCR, appendix 9, requirement for synchronization and this was verified by testing and vendor's submission of a Letter of Compliance (LoC). The SUT also supports synchronizing to a reference clock signal derived from the following sources (provisioned by the user as defined by the network synchronization plan):

- external timing
- line timing
- mixed timing

(2) Device Management

(a) Management Option. The SUT meets the management option requirements as defined in the GSCRm appendix 9. The SUT is managed via the Preside Site Manager Release 4.0 application running on a Windows XP personal computer. The management console was connected to the gateway node via IP. The management console, via in-band management, managed all other nodes in the test network.

(b) Fault Management. The SUT does not support fault management as defined in the GSCR, appendix 9. This requirement is conditional and has no major operational impact on network interoperability.

(c) Loop Back Capability. The SUT does not support International Telecommunication Unit (ITU) Recommendation V.54 "Loop Test Devices for Modems" as defined in the GSCR, appendix 9. This requirement is conditional and has no major operational impact on network interoperability.

(d) Operational Configuration Restoral. The SUT was placed into a power failure condition. The SUT returned to the last customer configured state prior to the power failure as required in the GSCR, appendix 9.

(3) Security. Security is tested as part of the Information Assurance testing and is covered under a separate report.

(4) DSN Access Interfaces. The SUT supports both DS1 and DS3 interfaces. Channel Associated Signaling (CAS) and Common Channel Signaling trunks were provisioned and tested. All trunk types were provisioned and tested on the DSM and Adtran 2800 M13 Multiplexer. In addition, the SUT supports Gigabit and 10 Gigabit Ethernet interfaces. All of the interface types were mapped through the test network via VT1.5 and STS-1 transport levels over all of the supported SONET interfaces described in paragraph (5). The specific requirements and test results of the DSN Access Interface testing are described below.

(a) Interface Characteristics. The DS1 and DS3 interfaces characteristics were tested according to GSCR, appendix 9. The DS1 interface

supports both Alternate Mark Inversion (AMI) and Bipolar Eight Zero Substitution (B8ZS) line coding, as required by the GSCR, appendix 9. The DS3 interface supports both C-bit and M13 framing. All Access interface characteristics were verified through both vendor LoC and testing.

       (b) Supervisory Channel Associated Signaling. Trunk seizure, answer supervision, preemption signals, and all other trunk supervisory information sent and received on a per channel basis was passed transparently through the SUT as required in the GSCR, appendix 9.

       (c) Clear Channel Capability. The SUT is capable of transmitting and receiving Bipolar Eights Zero Substitution (B8ZS) line coding in accordance with GSCR, appendix 9.

       (d) Alarm and Restoral Requirements. The SUT is capable of transparently passing the alarm and restoral features of the DSN switch's digital interface unit as required in the GSCR, appendix 9.

       (e) Mean Opinion Score (MOS). The Abacus call loader was used to generate voice traffic across the DS1 links mapped through the SUT test network as depicted in figures 2-2 and 2-3. There were 174,271 calls placed over the DS1 interfaces, with 99.99 percent of all calls placed via the SUT having a MOS of at least 4.0. The GSCR, appendix 9 states that a Network Element shall have a MOS of 4.0 or better for 95 percent of all calls placed.

       (f) Bit Error Rate Test (BERT). BERTs were conducted across DS1 and DS3 interfaces. The GSCR, appendix 9, requires that the SUT, when inserted in to the test network, will not exceed an end-to-end bit error rate of less than one error in $1x10^{9}$ (averaged over a nine hour period). The SUT met this requirement for all interfaces with a recorded bit error ratio of $1x10^{-9}$.

       (g) Secure Transmission (Voice and Data). There were 336 secure calls placed between Secure Terminal Equipment (STEs) and Secure Wireline Terminals (SWTs) without degrading transmissions between end devices. This satisfies the GSCR, appendix 9, requirement for degraded transmissions.

       (h) Modem. There were 6,264 modem calls placed through the SUT using the Abacus call loader. All modem calls had a transmission rate of 26.4 kilobits per second (kbps). The SUT supports the minimum modem transmission speed of 9.6 kbps as required in the GSCR, appendix 9.

       (i) Facsimile. There were 8,588 facsimile calls placed through the SUT using the Abacus call loader. All facsimile calls had a transmission rate of 14.4 kbps. The SUT supports the minimum modem transmission speed of 9.6 kbps as required in the GSCR, appendix 9.

(j) **Call Control Signals.** The SUT transparently transported all Multi-level Precedence and Preemption (MLPP) call control signals as required in the GSCR, appendix 9.

(k) **Call Congestion.** In accordance with the GSCR, appendix 9, call congestion handling can be met one of the following three ways: dynamic load control signal; software capability which makes congestion impossible; or congestion is not possible in the SUT. Call congestion in the SUT is not possible.

(l) **Voice Compression.** Voice compression is not a feature provided by the SUT. This requirement is conditional and has no operational impact on network interoperability.

(m) **Delay.** Delay occurs when packets take more time than expected to reach their destination. The GSCR, appendix 9, paragraph A9.5.1.2.9a, states the addition of Strategic Network Element (S-NE) shall not cause the one-way packet delay measured from ingress to egress to increase by more than five milliseconds (ms) for each S-NE used, averaged over any five-minute period. The Ixia test set was used to generate traffic and measure delay. The average one-way delay for each of the sampled five-minute periods, measured between NE devices, was 1 ms which met the requirement.

(n) **Jitter.** Jitter occurs when packets are sent and received with timing variations. The GSCR, appendix 9, paragraph A9.5.1.2.9b, states the addition of S-NE shall not cause jitter measured from ingress to egress to increase by more than five ms or less averaged over any five-minute period. The Ixia test set was used to generate traffic and measure jitter. With a bandwidth load, jitter was measured to be 0 ms over a five-minute period, which met the requirement.

(o) **Packet Loss.** Packet loss occurs when packets are sent, but not received at the final destination. The GSCR, appendix 9, paragraph A9.5.1.2.9c, states that the addition of an S-NE shall not cause packet loss measured from ingress to egress to increase by more than 0.05% averaged over any five-minute period. The Ixia test set was used to generate traffic and measure delay. With bandwidth load, the measured packet loss was 0.00% over a five minute period.

(5) **DSN Transport Interfaces.** The SUT supports SONET standard optical carrier link levels of OC-3, OC-12, OC-48, OC-192 and DWDM. The optical carrier links were tested in a direct-connect configuration and a fully redundant ring configuration. The SUT's SONET interfaces supported switching at the VT1.5 and STS-1 transport levels. The SUT, when configured at maximum capacity, provides for 36-channel DWDM each separated by 200 Ghz for a rate of 10 Gbps per channel. The specific requirements and results of the DSN Transport Interface testing are described in the paragraphs below. The respective optical carrier links were tested and certified for the architectures depicted in table 2-4.

Table 2-4. SUT Certified SONET Architectures

Optical Carrier Link Level	Certified Architecture
OC-192	UPSR, BLSR, 1+1
OC-48	UPSR, BLSR, 1+1
OC-12	UPSR, 1+1
OC-3	UPSR, 1+1

LEGEND:			
BLSR	- Bidirectional Line Switched Ring	OC-192	- Optical Carrier Level 192
OC-3	- Optical Carrier Level 3	SONET	- Synchronous Optical Network
OC-12	- Optical Carrier Level 12	SUT	- System Under Test
OC-48	- Optical Carrier Level 48	UPSR	- Unidirectional Path Switch Ring

(a) Military Unique Features. The SUT supports the full complement of Military Unique Features as required in the GSCR, appendix 5. MLPP calls were placed over T1 interface trunk types.

(b) Generic Requirement (GR)-303 CORE. The SUT was compliant with GR-303 CORE. This requirement was verified via the vendor's LoC.

(c) GR-253 CORE. The SUT was compliant with GR-253 CORE. This requirement was verified via the vendor's LoC.

(d) GR-782 CORE. The SUT was compliant with GR-782 CORE. This requirement was verified via the vendor's LoC.

(e) ANSI T1.105-2001. The SUT was compliant with ANSI T1.105-2001. This requirement was verified via the vendor's LoC.

(f) DS1 Rate Transport via VT1.5. All features and functions that are defined to operate at the DS1 rate worked transparently at the VT1.5 rate over the SUTs SONET interfaces, as required in the GSCR, appendix 5.

(g) DS1 Rate Provisioning. The SUT supports the provisioning of transport levels as low as the DS1 rate as required in the GSCR, appendix 5.

(h) DS0 to OC-3 Route Assignment. The SUT supported this requirement by transparently passing all trunk group(s) mapped through the test network as required in the GSCR, appendix 5.

(i) Facility Alarms. The SUT supported all facility alarms as required in the GSCR, appendix 5.

(j) DS1 Alarm Indication Signal (AIS: Blue Alarm) and DS1 Remote Alarm Indication (RAI:Yellow Alarm). The SUT transparently transported all DS1 Alarm Indication Signals and Yellow alarms as required in the GSCR, appendix 5.

(k) DS0 AIS/DS0 RAI/Yellow. The SUT transparently passed all DS0 level alarms required in the GSCR, appendix 5.

(l) **Synchronization.** The SUT was compliant with Synchronization GR-253 CORE, GR-436 CORE, and GR-518 CORE as required in the GSCR, appendix 5. This requirement was verified via the vendor's LoC.

(m) **Reliability.** The SUT was compliant with the reliability requirement as stated in the GSCR, appendix 5. This requirement was verified via the vendor's LoC.

(n) **Security.** Security is tested as part of the Information Assurance testing and is covered under a separate report.

(o) **MOS.** The Abacus call loader was used to generate voice traffic across the DS1 links mapped through the SONET test network as depicted in figure 2-2. There were 174,271 calls placed over the DS1 interfaces, with 99.99 percent of all calls placed, via the SUT, having a MOS of at least 4.0. The GSCR, appendix 9 requires that a Network Element shall have a MOS of 4.0 or better for 95 percent of all calls placed. The IXIA data loader was also used to generate voice traffic over the 1Gbps Ethernet Private Line (EPL), 10Gbps EPL and 1Gbps RPR mapped through the SONET test network. The IXIA voice traffic had a minimum MOS of 4.37.

(p) **BERT.** BERTs were conducted across DS1 trunk type interfaces, which were mapped through the SONET test network. The SUT, when introduced in to the test network did not cause the end-to-end digital bit error rate requirement of less than 1 error in 1×10^9 (averaged over a nine hour period) to be exceeded as required in the GSCR, appendix 9. The SUT met this requirement for all interfaces with a recorded bit error ratio of one error in 1×10^9 averaged over a nine hour period.

(q) **Secure Transmission (Voice and Data).** The SUT did not degrade secure transmission of end devices as required in the GSCR, appendix 9. There were 336 secure calls placed between STU-IIIs, STEs, and SWTs.

(r) **Modem.** There were 6,264 modem calls placed through the SUT using the Abacus call loader. All modem calls had a transmission rate of 26.4 kbps. The SUT supports the minimum modem transmission speed of 9.6 kbps as required in the GSCR, appendix 9.

(s) **Facsimile.** There were 8,588 facsimile calls were placed through the SUT using the Abacus call loader. All facsimile calls had a transmission rate of 14.4 kbps. The SUT supports the minimum modem transmission speed of 9.6 kbps as required in the GSCR, appendix 9.

(t) **Call Control Signals.** The SUT transparently transported all MLPP call control signals as required in the GSCR, appendix 9.

(u) **Call Congestion.** In accordance with the GSCR, appendix 9, call congestion handling can be met one of the following three ways: dynamic load control

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signal; software capability which makes congestion impossible; or congestion is not possible in the SUT. Call congestion in the SUT is not possible.

        (v) Voice Compression. Voice compression is not a feature provided by the SUT.

        (w) Delay. There were IXIA VoIP pairs generated through the SUT using the Ixia. Per the GSCR, appendix 9, the SUT supported the requirement that the S-NE shall not cause the one-way packet delay measured from ingress to egress to increase by more than five milliseconds (ms) for each S-NE used, averaged over any five-minute period. The IXIA VoIP pairs measured an average latency of 1ms.

        (x) Jitter. With IXIA VoIP pairs generated through the SUT using the Ixia, the SUT supports the requirement that the addition of an S-NE shall not cause jitter measured from ingress to egress to increase by more than 5 ms averaged over any five-minute period. The IXIA VoIP pairs measured 0ms of jitter.

        (y) Packet Loss. Packet loss occurs when packets are sent, but not received at the final destination. The GSCR, appendix 9, paragraph A9.5.1.2.9c, states that the addition of an S-NE shall not cause packet loss measured from ingress to egress to increase by more than 0.05% averaged over any five-minute period. With bandwidth load, the measured packet loss was 0.00% over a five minute period.

        (z) Call Congestion. In accordance with the GSCR, appendix 9, call congestion handling can be met one of the following three ways: dynamic load control signal; software capability which makes congestion impossible; or congestion is not possible in the SUT. Call congestion in the SUT is not possible.

        (aa) Differentiated Services. The NE shall be able to classify the DSN traffic by either IEEE 802.1p prioritization bits and/or Differentiated Services Code Point (DSCP) values. The NE shall be capable of assigning any value of prioritization to the DSN traffic, 0 through 7 for 802.1p, or 0 through 63 for DSCP. If the bearer and signaling sessions are different streams, the NE shall be capable of marking them independently. The SUT is only capable of prioritization based on IEEE 802.1p and any circuit utilizing the RPR must be configured to utilize and provide IEEE 802.1p.

   b. Summary. The SUT is certified for joint use within the DSN as a Strategic Network Element in accordance with the requirements set forth in reference (c). When connected to the interfaces certified in this letter, the SUT and its associated applications were transparent to the switching systems interfaced causing no degradation of service or negative impact, and met all the critical interoperability requirements.

12. TEST AND ANALYSIS REPORT. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses

Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at https://stp.fhu.disa.mil. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at http://jit.fhu.disa.mil (NIPRNet), or http://199.208.204.125 (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at http://jitc.fhu.disa.mil/tssi.